DEEPWATER OFFSHORE OIL DEVELOPMENT: OPPORTUNITIES AND FUTURE CHALLENGES

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Introduction

As we move into the next millennium, a larger percentage of oil and natural gas will come from the oceans. The United States has a significant opportunity to influence the future course of events from both a private sector and government perspective and guarantee that there will be secure access to this important source of energy in the years ahead.

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Extraction of petroleum resources from beneath the seabed is a major maritime activity in the Gulf of Mexico, offshore southern California, and in some regions of Alaska. Petroleum production from offshore federal lands currently accounts for 20 percent of our oil production and 27 percent of domestic natural gas production. The offshore oil and gas industry, including the support services sector, provides Americans with approximately 85,000 well-paying jobs, a number which is likely to more than double in the next two decades. Oil production in the Gulf of Mexico, where there is a high level of industry interest and activity in waters as deep as 8,000 to 10,000 feet, is expected to double by the year 2002. Revenues from OCS oil and gas development generate an average of $3-4 billion a year in federal receipts and help fund the Land and Water Conservation Fund and the National Historic Preservation Fund.

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Deepwater Successes

Offshore petroleum production is a major technological triumph. New exploration, drilling, and production-related technologies have brought about world-record complex industrial projects in 3,000 to 5,000 feet of water, which would have been unimaginable a generation ago. Exploration wells have been drilled in almost 8,000 feet of water and 10,000 feet seems within reach. There are at least 8 known fields at depths exceeding 1,500 feet of water with 1 billion barrels or more of oil in place. These are located offshore 5 countries– the United States, Brazil, Nigeria, Cabinda, and Angola. In all, there have been 52 deepwater discoveries in the U.S. Gulf, 20 offshore Brazil, and 17 offshore West Africa, for a combined total of almost 23 billion barrels of oil equivalent. Much of this technology can be used in other ocean exploration endeavors and in scientific research, as well as in non-ocean fields such as communications and medicine.

Subsalt Plays

The same 3D seismic technology that has enabled oil and gas explorers to look into ever-deeper water at deeper geological targets has also enabled improvement in subsalt imaging in the Gulf of Mexico. Approximately 60 percent of the ocean floor in the Gulf contains salt structures beneath it which, until the advent of this new technology, kept us from seeing potential hydrocarbon–bearing structures below them. The subsalt play in the Gulf holds excellent potential for significant new finds and perhaps a number of giant fields. Only 44 wildcat wells have been drilled in the subsalt compared to more than 600 wildcats in the Gulf's deepwater. Anadarko Petroleum's discoveries last year at Tanzanite and Hickory represent important new oil and gas discoveries in the shallower waters of the Gulf, and similar potential discoveries lie in deeper water.

Safety and the Environment

Advances in technology and pacesetting safety management systems have also contributed to an improved Outer Continental Shelf (OCS) safety and environmental record. Over the past 20 years, less than 0.001 percent of the oil produced from the OCS has been spilled from production facilities. There has not been a spill larger than 1,000 barrels from oil and gas platforms on the Outer Continental Shelf since 1980; in fact, natural seeps introduce approximately 100 times more oil into U.S. marine waters than do spills from offshore development and production activities. Today industry, the Department of the Interior's Minerals Management Service, and the U.S. Coast Guard are working in partnership to raise the bar for environmental and safety performance even higher.

Moving beyond Conflict to Consensus; Extension of Moratoria Premature

Under the past two administrations, the Minerals Management Service (MMS) in the Department of the Interior has committed itself to resolve conflicts raised in connection with OCS oil and gas development and build a consensus among stakeholders as to where, when, and how activities should proceed. A parallel theme has been science-based decision-making. This approach is being used in the current 1997-2002 five-year OCS leasing program, and our coastal state administrations seem to be much more satisfied with the degree of communication and consideration that now exists between the federal government and the states regarding OCS oil and gas policy. For this reason, I believe it was premature for President Clinton last June, at the National Ocean Conference held in Monterey California, to extend OCS moratoria beyond 2000. We should have let these consensus-building policies work and evaluated their success before extending moratoria further.

Another consideration is the incredible advances in drilling technology made over the past decade, which make the extraction of oil and natural gas from the ocean much safer from an environmental standpoint and much less intrusive physically. A number of the areas in moratoria contain important reserves of natural gas, which cannot be spilled and is more and more the fuel of choice. Moreover, despite current appearances, the world will have a difficult enough time as it is supplying the energy needs of the 7 billion citizens who will inhabit our planet by 2010–at least a billion more than there are today, another China. We need to leave ourselves some flexibility to deal with changing international conditions or evolving domestic conditions and attitudes.

Global Leadership

As exploration of the ocean for hydrocarbons globalizes, the U.S. private sector and government have an unparalleled opportunity to lead the world in terms of management, technology, and our ability to demonstrate how to extract these resources in an environmentally sound manner for the benefit of all mankind.

Benefits of Offshore Oil Technology for Other Ocean Research and Activities

In 1998, we experienced a mini-boom in state-of-the-art mobile offshore drilling rig construction. Rigs delivered last year cost around $1.2 billion; rigs on order or planned will cost their owners at least an additional $12 billion, an average cost of $205 million per unit. New construction will peak in 1999 at 34 deliveries, then taper off to almost nothing as rig demand reacts to continuing low oil prices. Research done for such facilities on subjects such as composite materials, synthetic mooring lines, and other topics targeted at reducing the weight of materials in deep water should benefit many sectors in the marine environment. An industry/government coalition known as "Deep Star" has spent more than $6 million in research on deepwater technology challenges in the last few years.

Parallel developments have occurred in the offshore service vessel fleet, where new deep-draft, very large, high-horsepower anchor handling/tug/supply vessels have evolved to move these large new sophisticated drilling rigs, handle their anchors, chain and mooring lines, and meet all kinds of service demands of the new generation of deepwater rigs and production platforms.

As stated recently in a report of the National Research Council,[1] "ocean observations have always been the driver of new knowledge and predictive capabilities in the ocean and its basins. Ocean drilling has produced sediment cores that provide our best long-term records of natural climate fluctuations. Submersible observations (both piloted and robotic) opened our eyes to hydrothermal vents and the unique life forms that surround them." Many of the technological improvements enabling us to make these observations are driven by the needs of oil and gas explorers in the ocean. Certainly this is the case

with drilling, submersible vessels, and robotics. Much of our knowledge of seabed geology and geomorphology is directly owing to the offshore oil and gas industry. Just last month, a Louisiana-based company announced the development of a new process that gives a clearer picture of the ocean floor for better planning of drilling and construction. A new scanning sonar system collects seafloor features data in conjunction with proprietary image enhancement and analyzes software. The combination gives greater definition and resolution of seafloor features and hazards. Today in Houston we have a large-screen, interactive visualization center which allows engineers and earth scientists to course through 3D volumes of subsurface data worldwide. Also, companies are discussing the possibility of making available to the scientific community video film taken by various petroleum companies around wellheads in ultra–deep water for purposes of examining the marine ecosystem at these depths and identifying organisms not previously seen. As all these examples indicate, there is much potential for acquiring knowledge about the ocean environment through more joint efforts among industry, government, universities, and the scientific community at large. Today, scientists are using offshore rigs and platforms to study everything from marine organisms, physical oceanography, and meteorological data to bird migration. The day is approaching when abandoned offshore oil and gas platforms will be used for aquaculture projects. A converted offshore drilling rig is preparing to leave Russia for Long Beach, California, where it will be stationed to begin its new life as a privately owned commercial offshore rocket launch platform. Seventeen satellite launches are already contracted. Opportunities for the use of this technology are diverse and just abound!

Challenges Ahead

Before the potential of the deep water can be fully unlocked, there are a variety of economic, technological, environmental, and regulatory challenges to be overcome.

Costs reduction is a very important factor, particularly in the low oil price environment we are experiencing currently. One of the biggest challenges is the addition of a drilling function to a floating production, storage, and offloading system (FPSO) so as to have minimum reliance on shore-based facilities. MMS is currently studying FPSOs for application in the deepwater Gulf of Mexico along with industry. Another means of reducing costs is to operate through a "hub system" which handles production from two or more producing zones at a single facilities measurement point. This provides technical and regulatory challenges for the industry and the MMS as they meet their respective responsibilities to produce and measure production.

Deeper and colder waters create real and expensive problems with hydrates, paraffin, and solids build-up, so much research is being done to enhance flow assurance with solutions such as new types of insulation materials and coiled tubing. At the same time, the depths of some of the wells themselves have brought us to new pressure and temperature (excess of 200ºC) frontiers that have to be dealt with.

Multilateral completions are driving the need for more sophisticated downhole production systems.

For the geophysical industry, ever deeper water, deeper geophysical targets, the need to get the appropriate velocity field below salt and other complex frontier stratigraphy present far greater challenges to accurate acquisition of 3D seismic data than do normal depths and geology. The technological cutting edge that is reducing these obstacles to accurate surveys is proving to be the towing of longer cables on multi-streamer programs.

Deeper geological targets may require streamer lengths between 4,000 and 6,000 meters or more, rather than the standard lengths up to 3,600 meters. When four to eight streamers of the longer lengths are towed over large areas it can be a challenge to deploy them and maintain their positions.

These examples should give you some idea of the challenges deepwater operators are dealing with every day.

Law of the Sea Treaty

In closing, I want to make one more point that, as petroleum exploration moves into deeper and deeper waters, it is important that the United States become a party to the Law of the Sea Treaty this would assure the United States of a minimum of 200 nautical miles of OCS jurisdiction and establish rules and procedures for delineating the outer limits of the geological continental shelf, which in some areas extends considerably farther. That component of the Treaty which protects the right of both commercial and military ships and aircraft to move freely through and over straits used for international navigation, to engage in "innocent passage" through States' territorial seas, and to enjoy high seas freedom of passage

through exclusive economic zones, also is important to U.S. energy security as our sources of petroleum globalize and diversify in the years ahead and we become even more dependent on secure ocean transportation.

There presently exist about 200 undemarcated claims in the world with 30 to 40 actively in dispute. There are 24 island disputes. The end of the Cold War and global expansion of free market economies have created new incentives to resolve these disputes, particularly with regard to offshore oil and gas exploration. During the first 6 months of 1997, alone 172 licenses, leases or other contracts for exploration rights were granted in a variety of nations outside the United States. These countries are eager to determine whether or not hydrocarbons are present in their continental shelves, and disputes over maritime boundaries are obstacles to states and business organizations. We have two such cases here in North America, where bilateral efforts are underway to resolve the maritime boundaries between the United States. and Mexico in the Gulf of Mexico and between the United States. and Canada in the Beaufort Sea. Both of these initiatives have been driven by promising new petroleum discoveries in the regions. As I understand it, the Canadians do not seem to be in a hurry to resolve that boundary line. On the other hand, negotiations with Mexico are expected to resume in the spring of this year, after the Mexicans complete some geological analyses and technical research now underway.

The Law of the Sea Convention provides stability and recognized international authority, standards, and procedures for use in areas of potential boundary dispute as well as an additional forum for dealing with such disputes and other issues.

Notes

1 *Opportunities in Ocean Sciences: Challenges on the Horizon,* Ocean Studies Board, Commission on Geosciences, Environment and Resources, National Research Council.